"JP-10"

From: Barton Maher
Sent: Monday, 7 February 2011 10:00 AM
To: Jim Pruss; Rob Drury
Subject: Impact of Reducing the Full Supply Level of Wivenhoe on Flood Discharges V1 SKM Review.docx

Hi Jim and Rob,

Report as it stands at the moment. Have sent to Rory Nathan for a review at lunch time. He has already reviewed twice.

Regards,
Barton

Impact of Reducing the Full Supply Level of Wivenhoe on Flood Discharges

1 Contents

2 Introduction

Seqwater staff have been asked to investigate the impact of reducing the storage level of Wivenhoe Dam on the downstream discharges for major flood events. This memo details the investigations carried out and provides a preliminary assessment of the reduction in flood flows that could be achieved by reducing the Wivenhoe Dam storage level to 95%, 90%, 75% and 50% of the normal water supply volume.

The comments in this report are provided to give an indication of the impacts of a reduced storage level of Wivenhoe Dam on discharges during major flood events. It must be noted that it is very preliminary, as to get accurate results a full investigation and analysis of the whole river system utilising multiple flood events and a combination of hydrologic, hydraulic, and routing models would be required. This review was requested to provide an order of magnitude assessment of impacts and the results should not be utilised beyond that purpose.

3 Definitions

For the purposes of this report the following definitions have been adopted as per the Wivenhoe – Somerset Flood manual:

Fresh	This causes only very low-level bridges to be submerged.
Minor Flooding	This causes inconvenience such as closing minor roads and the submergence of low-level bridges. Some urban properties are affected.
Moderate Flooding	This causes inundation of low-lying areas and may require the evacuation of some houses and/or business premises. Traffic bridges may be closed.
Major Flooding	This causes flooding of appreciable urban areas. Properties may become isolated. Major disruption occurs to traffic. Evacuation of many houses and business premises may be required.
Extreme Flooding	This causes flooding well in excess of floods in living memory and general evacuation of whole areas are likely to be required.
"m^3/s"	Means an instantaneous flow rate expressed as cubic meters of water per second.
"AEP"	means annual exceedance probability, the probability of a specified event being exceeded in any year;
"AHD"	means Australian Height Datum;
"EL"	means elevation in metres from Australian Height Datum;
"ML"	Means a million litres of water

4 Background

4.1 Previous Flood Studies

The original design of Wivenhoe Dam was to provide both water supply for South East Queensland and flood mitigation for the city of Brisbane. There have been several flood studies prepared for the dam as discussed below.

Wivenhoe Dam has a catchment area of about 7,048 km^2. The current spillway capacity of Wivenhoe Dam is based on a PMF inflow of 15,090 m^3/s made by the Queensland Water Resource Commission (WRC) in 1977 (Hausler and Porter, 1977). This estimate was based on a 48-hour duration probable maximum precipitation (PMP) estimate of 480 mm and synthetic unit graphs using the Clarke Johnson method.

WRC revised the design flood estimates in 1983 when the dam was in its final phase of construction. This revision was brought about because the Commonwealth Bureau of Meteorology (BOM) had revised their estimate of the PMP for the Wivenhoe catchment.

In addition, better rainfall-runoff-routing techniques were available at that time to derive design flows. The revised PMF inflow estimated in 1983 was 48,000 m^3/s, which is some 220% above the 1977 estimate. The increase was mainly attributed to the changes in the PMP, which increased to 1,000 mm for the 48-hour duration storm.

The Department of Natural Resources (DNR) (formally WRC) revised the design flows again as part of a comprehensive safety review of the dam undertaken between 1990 and 1994. Rainfall-runoff-routing models of the catchment were developed together with a dam flood routing model used to derive outflows from Somerset and Wivenhoe Dams taking into account the flood operating procedures used at that time. Somerset Dam, which has a catchment area of 1,331 km^2 drains into Wivenhoe Dam.

As part of the review, the BOM was requested to update the PMP estimates for the catchment (BOM, 1991). The revised PMP estimates were used in the 1994 analysis to estimate PMF. DNR estimated the PMF inflow to be 39,880 m^3/s, which is lower than the 1983 estimate but still substantially higher than the 1977 estimate. The lower PMF estimate were mainly attributed (again) to changes in the PMP, which was revised down to 870 mm for the 48-hour duration storm. The development and calibration of the rainfall runoff routing model was also much more comprehensive than previous studies. Flood operating procedures were also incorporated into the models to estimate design outflows.

A detailed review of the previous studies is provided in Report No. 8a of the DNR flood study reports (1994).

The BOM updated the PMP estimates in 2002/2003 for the Wivenhoe catchment using the revised Generalised Tropical Storm Method (BOM, 2003). This report also provides the latest information on temporal patterns and spatial rainfall weightings to be used with the new PMP data. The 2003 PMP estimates are some 20% higher than PMP estimates used by DNR in the 1994 study. As a result, the new PMF estimate for the catchment using this data is significantly higher than the 1994 estimate. The new estimate was used for the upgrade of the dam in 2004/2005 by the Wivenhoe Alliance. The DNR models (1994) were used to estimate design flows for Wivenhoe Alliance.

For the purposes of this study design hydrographs from the Wivenhoe Alliance have been used along with recorded data from three historic flood events.

4.2 Flood Mitigation

The Design Report for Wivenhoe Dam (DPI 1994) provides a summary on the design of the flood mitigation component of the dam. The report indicates that *the estimated PMF was used to assess the safety of the dam against overtopping. In additon, inflow hydrographs from various historical floods (eg the 1893 and the 1974 floods) and for floods synthesised from storm frequency data were developed in order to provide data for the benefit – cost analysis for the flood mitigation component of the dam.*

For the flood mitigation benfit – costs studies, the historic and synthesised floods were routed through the dam and the ouflow routed down the Brisbane River. The objectives were to limit outflow below a damaging level for Brisbane with the available storage and to empty the dam within a reasonable time, say 5 or 6 days, after the reservoir had reached the maximum level.

The results of the flood rouitng for the economic studies are summarised in a report by Grigg. The 1974 flood, which reached 5.45meteres on the Brisbane City Gauge, would have been lowered by 2.6m if Wivenhoe Dam had then been in existence. The damage caused by the 1974 flood was estimated at $178M, and the savings produced by the lowering the flood level would have been $140M.

The flood mitigation studie indicated that all major historical floods could be controlled with outflows not exceeeding 3,200m3/s. If no other inflows occur below the dam, prolonged outflow of this magnitude would cause little or no damage to Brisbane. The dam would then be able to be emptied in a reasonable time frame after a major flood such as the 1893 flood.

An extract of the design report detailing the design of the spillway is presented as Attachment 2.

5 Assessment of the Impact of Lowering the Full Supply Level

Lowering the full supply level was assessed to determine the impact on the peak flood levels and discharges.

5.1 Analysis Methodology

The analysis was undertaken using a spreadsheet developed to model the gate opening sequence as provided in the Flood Manual during a loss of communications situation. During a loss of communications between the dam operators and the Flood Control Centre, operators would use predefined gate openings based solely on the Lake Level information available to them at the dams. It should be stressed that in practice gate operations would normally seek to take advantage of additional information related to rainfall forecasts and tributary flows to ensure that flood peaks are reduced as far as possible without causing coincident flooding with downstream tributaries. Thus, while using the "loss of communications" flood operation rules provides a consistent means of comparing the efficacy of different mitigation options, the actual degree of flood reduction achievable is dependent on the characteristics of the specific event.

A history of floods in the Brisbane River is presented in Table 1.

Table 1 – Summary of Significant Flood Events in the Brisbane River

Event	Somerset Dam			Wivenhoe Dam		
	Peak Elevation	Inflow	Outflow	Peak Elevation	Total Inflow Flood Volume	Outflow Flood Volume
	m AHD	ML	ML	m AHD	ML	ML
Jan 1974#	106.57	620,000	450,000	73.31	1,410,000	1,410,000
Jun 1983	101.58	260,000	280,000	69.49	1,080,000	470,000
Mar 1989	102.59	370,000	380,000	69.78	690,000	660,000
Apr 1989	102.69	340,000	350,000	71.45	870,000	820,000
Feb 1999	102.96	450,000	280,000	70.45	1,220,000	900,000
May 2009	99.62	110,000	110,000	62.19	235,000	0
Mar 2010	99.41	210,000	200,000	66.43	390,000	0
Oct 2010	101.37	250,000	270,000	69.61	630,000	630,000
Mid Dec 2010	100.42	150,000	140,000	67.50	360,000	330,000
Late Dec 2010	99.98	120,000	130,000	69.35	500,000	460,000
Jan 2011	105.11	825,000	820,000	74.97	2,650,000	2,650,000

Presence of Wivenhoe Dam simulated

The assessment has investigated the impacts of the lowered storage level on the three largest events – the 1974 flood, the 1999 flood and the 2011 flood.

Plots of the inflow and estimated outflow for these events are presented in Figure 1.

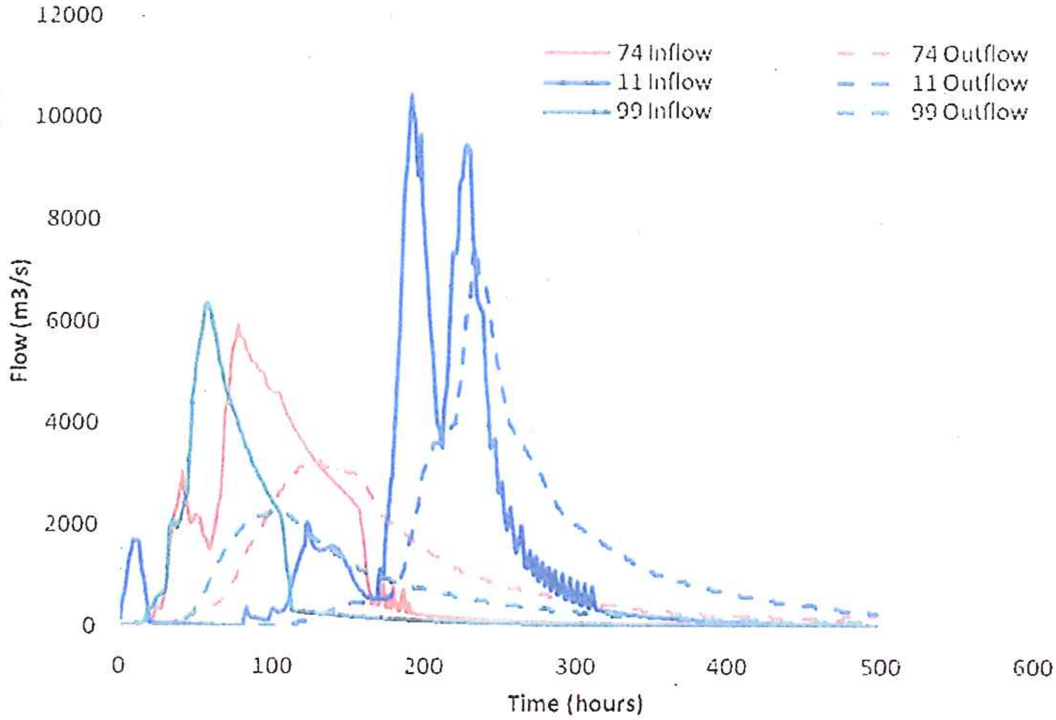

Figure 1 - Plots of Historic Events with Simulated Outflows

5.2 Analysis Results

A summary of the results of the modelling is presented in Table 2.

Table 2 – Reduction in flood peak due to adoption of different initial storage levels

		Wivenhoe Dam		Somerset Dam		Lockyer Creek	Lowood	Bremer River	Moggill	Reduction at Moggill
Storage Level at Start	% of Full Supply Volume	Peak Inflow (m³/s)	Peak Outflow (m³/s)	Peak Inflow (m³/s)	Peak Outflow (m³/s)	Peak Flow (m³/s)	Peak Flow (m³/s)	Peak Flow (m³/s)	Peak Flow[1] (m³/s)	%
1974 Flood										
67.0	100	5,953	3,275	5,019	3,548	3,260	5,110	4,241	7,948	
66.5	95	5,953	3,153	5,019	3,480	3,260	4,799	4,241	7,910	0.5%
65.8	90	5,953	2,974	5,019	3,419	3,260	4,524	4,241	7,897	0.6%
64.0	75	5,953	2,618	5,019	3,302	3,260	4,117	4,241	7,683	3.3%
60.0	50	5,953	2,067	5,019	3,040	3,260	3,342	4,241	7,423	6.6%
1999 Flood										
67.0	100	6,358	2,312	7,540	3,837	663	2,556	308	2,593	
66.5	95	6,358	2,132	7,540	3,662	663	2,434	308	2,479	4.4%
65.8	90	6,358	2,003	7,540	3,470	663	2,284	308	2,319	10.6%

[1] Note the flows quoted for Moggill are based on the addition of outflows from the dam and the measured flows at Lockyer Creek and the Bremer River. They do not have any allowance for routing of the flows through the river system and the subsequent reduction in flows that were observed during the actual flood events.

64.0	75	6,358	1,687	7,540	3,214	663	1,906	308	1,936	25.3%
60.0	50	6,358	1,007	7,540	2,798	663	1,186	308	1,214	53.2%
2011 Flood										
67.0	100	10,470	7,528	3,824	2,814	3,040	10,495	2,793	13,104	
66.5	95	10,470	7,453	3,824	2,798	3,040	10,445	2,793	13,004	0.8%
65.8	90	10,470	6,756	3,824	2,815	3,040	9,791	2,793	12,302	6.1%
64.0	75	10,470	5,748	3,824	2,680	3,040	8,788	2,793	11,110	15.2%
60.0	50	10,470	4,209	3,824	1,595	3,040	7,249	2,793	9,582	26.9%

The preliminary work done by Seqwater before Christmas 2010 showed that for the October 2010 event, reducing the level of Wivenhoe by small amounts would have had minimal impact on the flood releases. From the Table 2 the following comments are applicable:

- Similarly to work completed previously, reducing levels by small amounts prior to the January 2011 Event (if it was feasible) would have had little impact on the peak level in Wivenhoe Dam as shown in the Table 2. The reason for this is that the total event inflow volume of 2,600,000 ML is well in excess of the useable flood storage combined with the available water supply storages shown in the table. Large reductions to the storage level of the dam (25 to 50%) would be required if significant impacts on flooding are to be achieved.
- For the 1999 flood, where most of the flooding occurred upstream of the Wivenhoe Dam, there is a dramatic reduction in the peak outflow if the storage is lowered. However, this is of little benefit as the flood would not have resulted in damaging flows downstream of the dam even if the storage was full.
- The 1974 flood simulation is based on the recorded flows being routed through the both Somerset and Wivenhoe. The presence of Wivenhoe would have reduced the flooding damage in Brisbane during the 1974 event, however there is very little change to the flood mitigation benefits by varying the storage level in Wivenhoe. As most of the flood flows in 1974 were downstream of the dam and the flood in the Brisbane River was relatively small compared to the downstream flooding the event is insensitive to the starting level in Wivenhoe.
- It should be noted that the increasing early releases from Wivenhoe was investigated during the Brisbane Valley Flood Damages Study as part of a review of the operation of the dam. Releasing more water earlier on from Wivenhoe dam was shown to lessen the flood mitigation benefits compared with the existing flood manual release strategies.

The key point being that each flood event is unique and presents varying opportunities to mitigate flows through Brisbane.

5.3 Downstream Water Level Changes

To evaluate the specific impact on the Lower Brisbane River of these reduced dam outflows from lowering the storage requires the use of a complex hydraulic model. The results of this modelling would still contain a degree of uncertainty as illustrated by the difficulties in estimating the final flood peak in Brisbane during the event. The uncertainty was partly due to the rapid closure of the Wivenhoe gates after the peak inflow of the flood and the attenuation achieved in the downstream river system. It is extremely difficult to model accurately.

Given the timeframe of this report it is not possible to generate any reliable estimate of the changes to the water level at the Port Office Gauge due to tidal influences, the need to interpolate between previously modelled results that vary markedly between differing events, the availability of verified data, and the uncertainty surrounding the timing of peak flows for the differing scenarios.

Table 3 shows a comparison of the peak water level for each of the various starting levels for the 2011 Flood Event. It should be noted that each scenario results in the storage level exceeding EL74 requiring the gates to be opened until the storage rise is stopped. These estimates of flood levels at the Port Office are based on the interpolation and scaling of previously modelled results – these estimates should thus be regarded as indicative only.

Table 3 - Preliminary Estimate of Brisbane Levels Changes due to Lowering Wivenhoe for the 2011 flood

Wivenhoe Dam				Approximate reduction in level
Starting Level		**Peak Height**	**Capacity at Peak Height**	**Brisbane Port Gauge**
%	m AHD	m AHD	%	m
100	67.0	74.98	191.1	0
95	66.5	74.93	190.6	0 to 0.1
90	65.8	74.88	189.9	0.1 to 0.3
75	64.0	74.63	186.5	0.2 to 0.6
50	60.0	74.11	179.6	0.4 to 0.9

It is seen that appreciable reductions could only have been achieved when the storage is drawn down towards the lowest levels considered.

It should also be noted that to accurately calculate the impacts of reducing the storage levels of Wivenhoe Dam at the start of a major flood event requires considerable study as rainfall events of different intensity, duration, peak, location and spread will give very different outcomes. In addition, there is the need to do detailed hydraulic analysis of the river system for each scenario to more accurately determine impacts.

5.4 Summary

Due to the large volumes of water associated with major flood events in the Brisbane River (that is with events with annual exceedance probabilities rarer than 1 in 100), to effectively reduce flood peak discharges significantly would require the storage level of Wivenhoe Dam to be lowered by at least 25 to 50%.

6 Contingency Options

There is the possibility of further flood events in the South East Queensland during the 2010/2011 wet season. To reduce the risk of flooding in Brisbane should a major rainfall event be predicted it has been requested that lowering of the storage level of Wivenhoe Dam be investigated to determine if this is a feasible option to further mitigate flood flows.

The assessment carried out by Seqwater has indicated that to have any significant impact on releases downstream of Wivenhoe Dam during a major flood event it would be necessary to lower the storage level by 25 to 50%.

There are five options considered going forward:

- "Option 0" - Continue with the current approved flood manual strategies
- "Option 1" - Commence drawing down the storage at a safe rate to bring it down to say 75%.
- "Option 2" - Pre-release water from the dam following the prediction of a major rainfall event
- "Option 3" - Change the flood manual strategies to ignore the early strategies designed to minimise disruption to the rural communities.
- "Option 4" - Temporarily reduce the full supply of Wivenhoe Dam and amend the flood releases to commence flood operations from the lowered full supply level.

6.1 Do Nothing Option – Continue with the Current Flood Manual

This option maintains the status quo and continues to utilise the dam as originally designed. This option has the least risks associated with it as the Strategies have been implemented and refined over several flood events and the manual was developed by a comprehensive study. The strategies in the flood manual have proved adequate for more frequent flood events.

6.2 Option 1 – Vary the early strategies for the Flood Manual

It has been proposed that increasing the releases from the dam up to 1,600 m^3/s as soon as practicable after gate operations commence may deliver reduced peak flood levels. This has been investigated to assess the impact of attempting to release more water at the very start of an event.

This option has been assessed using a range of design events from the Wivenhoe Alliance Design hydrology. To model the impacts of increasing releases up to 1,600 m^3/s as soon as practicable a range of design flood events from the Wivenhoe Alliance were compared using the program FLROUTE. . It was assumed that no attempt would be made to maintain bridge access downstream of the dam other than Mt Crosby Weir Bridge and the Brisbane Valley Highway Bridge.

The results for the model runs are presented in Table 4.

Table 4 - Comparison of Release Strategies

Flood Event			Existing Rules		Amended Rules		
Event description	Maximum Inflow (m^3/s)	Flood Volume (ML)	Maximum Outflow (m^3/s)	Maximum Lake Level (m AHD)	Maximum Outflow (m^3/s)	Maximum Lake Level (m AHD)	Flow Reduction %
36 hour 1 in 200 design*	8,214	1,544,119	3,861	71.43	3,613	71.27	6.4%
36 hours 1 in 500 design	10,455	1,624,119	5,125	72.22	4,915	72.09	4.1%
36 hours 1 in 1000 design	12,031	1,772,752	6,049	72.8	5,854	72.68	3.2%
48 hours 1 in 5000	14,278	2,562,553	9,083	74.71	8,994	74.66	1.0%

design							
72 hours 1 in 5000 design	13,181	2,880,602	8,204	74.16	8,101	74.10	1.3%
96 hours 1 in 5000 design	11,870	2,948,032	7,550	73.75	7,426	73.67	1.6%
120 hours 1 in 5000 design	12,727	3,005,136	7,265	73.57	6,986	73.39	3.8%
January 2011 historic							
1974 historic							
1999 historic							

It should be noted that predicted flood levels greater than EL 74 require the gates to be opened until the water level stabilises. This is fundamental to the dam's safety. In addition, any reduction in starting level, which does not achieve a peak lower than EL 74, is unlikely to have any impact upon peak release rate.

It can be clearly seen from Table 4 that changes to the early releases adopted for the flood manual strategies have minimal impact on the maximum outflow for the dam. The influence of reduced initial starting level decreases with increasing flood magnitude. For the major flood events investigated the reduction in peak outflow for the dam is negligible. Note that this analysis does not consider the downstream flooding in the Lockyer and Bremer Rivers.

However, it should be noted that there is the real risk that the release of additional water from the dam early in the flood event may make local flooding impacts in Brisbane worse. Due to the travel time of releases, uncertainty in forecast rainfall, and the low lying local catchment areas between Wivenhoe Dam and the urban areas of Brisbane, it is likely that for some events the increased early releases will exacerbate local flooding in Brisbane. This is potentially a significant risk as this flooding is directly attributable to the dam releases and could be avoided if the dam was operated according to the current strategy.

The flood strategies for Wivenhoe and Somerset are based on holding back flood waters until the rain has occurred and downstream flooding has peaked. Releasing early in an event compromises some of the flood mitigation capacity for the intermediate flood events.

6.3 Option 2 – Pre-release water when a major event is forecast

This option involves implementing a significant release of water once the notification of a major rainfall event has been received. This option is reliant on the accuracy of forecasts and having predefined approval processes in place.

The Bureau of Meteorology was approached by the SEQWater Corporation in 2006 to discuss the ability of the provision of short term forecasts of large rainfall events. Their response is included in Attachment A. The summary of their advice from the meeting was:

"In light of the demand for water in southeast Queensland and the highly variable nature of rainfall in the area the project has many obvious attractions. However the capability of the science to provide sufficiently reliable 24 to 48 hour advance predictions of high catchment average rainfalls is

limited. The Bureau would be willing to participate in future discussions on the subject and maybe able to assist with some service that would assist."

There are also physical constraints on the amount of water that can be released. To reduce Wivenhoe to 75% in 48 hours requires water to be released at a rate that would close all of the road crossings over the Brisbane River between the dam and the Jindalee Bridge (peak flow of over 1,900 m^3/s) and result in a final volume in Wivenhoe of around 66.8% during the third day if the gates were closed down using the established closure sequence after the 48 hours. If the high rainfall did occur, then the gates would no doubt remain open.

It is not possible to lower Wivenhoe to 50% within 3 days due to the incremental opening of the gates required for safety, the reduction in discharge through the gates with the dropping dam level, and the need to limit discharges below damaging flows through Brisbane.

In light of the above comment, pre-releases (i.e. releasing water prior to an event based on predicted rainfall) has significant risks associated with the strategy in terms of:

- The difficulty in actually releasing significant volumes of water,
- The potential impacts downstream if rainfall doesn't eventuate (disrupting the downstream community, causing minor damage to low lying areas, creating a "sunny day" flood event totally attributable to the dam, someone could be injured or washed away in such a release).
- The risk of exacerbating flooding by making releases that then add to flood levels downstream occurring after the pre-release. (i.e. the predicted rainfall occurs downstream of the dam while the river level is elevated due to the pre-release's from the dam combining to create a damaging flood).
- Predicting rainfall 2 days before an event is highly variable even according to the Bureau of Meteorology and 3 days is problematic.

6.4 Option 3 – Lower the Storage Level by Sunny Day Releases to 75% and operate under the current flood manual

This option involves effectively lowering the Full Supply Level of Wivenhoe Dam to increase the flood mitigation storage at the commencement of a flood event. As discussed previously, the storage would need to be lowered by 25 to 50% to provide a significant reduction in peak flows for a major flood event. Once the storage level reached EL67 gate operations would commence as per the current flood manual.

To safely lower the storage it is proposed that this option would be implemented by "Sunny Day" releases at a rate low enough to minimise disruption to the rural areas. This would be difficult to implement during a wet year where the risk of major flooding is greater.

In the 25 days leading up to the January 2011 Flood event, three flood events impacting on Wivenhoe Dam were experienced, with gate releases being made on all but five of those days. The total outflow from these events was around 790,000ML.

During these events, multiple requests were received from Councils and residents impacted by bridge closures downstream of the dam to curtail releases as soon and as quickly as possible.

Additionally, the 2 January end date of the flood event prior to the January 2011 Flood event meant that significant draw down of the dam prior to the onset of the January 2011 Flood event that commenced on 6 January 2011, was not possible without major bridge inundation downstream of the dam and without exceeding minor flood levels in the lower Brisbane River.

Additionally, a flood event was also experienced in October 2010 that resulted in a release of 640,000ML from the dam. Accordingly, to draw down the dam below full supply level prior to the start of the first December event would not have been possible without significant bridge inundation and without exceeding minor flood levels (as defined by BOM and BCC) in the lower Brisbane River.

In other words, preceding rainfall events to the January 2011 Major Flood event had created flooding that would have maintained the storage at the current FSL and prevent drawdown of the storage if such a strategy was proposed.

Risks to this strategy are:

- Compromising water security for South East Queensland by lowering the storage at the end of the each event. The impact on yield needs to be quantified.
- Having preceding rainfall events fill up the dam and prevent it from being lowered before a major flood event. Effectively compromising any effectiveness associated with this strategy.
- The limited discharges that can be utilised during sunny day flows in the river system. To reduce levels prior to summer would take some time without inundating any bridges and without any further inflows. To reduce from 100% to 50% and only impact on Twin Bridges and Savages Crossings and keep Colleges Crossing open could take some 5 to 6 weeks. Even if levels are reduced in Wivenhoe prior to summer, as occurred this summer, multiple rain events can fill the dam and would require significant releases to keep the storage level down.

6.5 Option 4 - Temporarily Lower the Full Supply Level to 85% and Amend the Flood Operations Manual

It was requested that the option of temporarily lowering the storage to 85% of the current storage capacity (for this option make EL65.25 the FSL, down from EL67) and amend the current flood manual to commence releases once the storage level exceeds EL65.5. The amended manual would retain the key level in the manual of EL74m, where the gates are opened until the flood level stops rising. This would require a change by the Queensland Government to the regulatory requirements and levels of service that the storage is operated under.

This amended change would result in flow reductions similar to that obtained from Option 3.

Table 5 - Impact of temporarily Lowering FSL to 85%

Flood Event			Existing Rules		Temporarily Reducing FSL.		
Event description	Maximum Inflow	Flood Volume	Maximum Outflow	Maximum Lake Level	Maximum Outflow	Maximum Lake Level	Flow Reduction

	(m^3/s)	(ML)	(m^3/s)	(m AHD)	(m^3/s)	(m AHD)	%
36 hour 1 in 200 design*	8,214	1,544,119	3,861	71.4	2,639	70.66	32%
36 hours 1 in 500 design	10,455	1,624,119	5,983	72.2	4,028	71.53	33%
36 hours 1 in 1000 design	12,031	1,772,752	6,010	72.78	5,031	72.16	16%
48 hours 1 in 5000 design	14,278	2,562,553	9,066	74.7	8,535	74.37	6%
72 hours 1 in 5000 design	13,181	2,880,602	8,204	74.15	7,821	73.92	5%
96 hours 1 in 5000 design	11,870	2,948,032	7,534	73.74	7,135	73.49	5%
120 hours 1 in 5000 design	12,727	3,005,136	7,227	73.55	6,751	73.25	7%
January 2011 historic	10,470	2,650,000	7,528	74.98	5,746	74.62	24%
1974 historic	5,953	1,410,000	3,275	73.305	2,737	72.91	16%
1999 historic	6,358	1,220,000	2,312	72.23	1,814	71.89	22%

* Design event characteristics obtained from WA (2005)

6.6 Option 5 - Temporarily Lower the Full Supply Level to 75% and Amend the Flood Operations Manual

It was requested that the option of temporarily lowering the storage to 75% of the current storage capacity (for this option make EL64 the FSL, down from EL67) and amend the current flood manual to commence releases once the storage level exceeds EL64. The amended manual would retain the key level in the manual of EL74m, where the gates are opened until the flood level stops rising. This would require a change by the Queensland Government to the regulatory requirements and levels of service that the storage is operated under.

As can be seen in Table 6 lowering the FSL to EL64 (75% of the current FSL) and commencing flood operations at this level has a profound impact on the discharges for the shorter duration flood events with smaller flood volumes. However, once the flood volume exceeds the 2,000,000ML mark the effectiveness of this change in the operating level is diminished resulting in only a 10% reduction in the peak outflows for the dam.

Given the January 2011 Event had a volume of over 2,500,000Ml the benefits from lowering the storage level would not have resulted in any major change to the extent of flood inundation. It would however have reduced the depth of inundation with a corresponding reduction in the number of house and commercial properties flooded.

Table 6 - Impact of temporarily Lowering FSL to 75%

Flood Event				Existing Rules		Temporarily Reducing FSL.	
Event description	Maximum Inflow (m^3/s)	Flood Volume (ML)	Maximum Outflow (m^3/s)	Maximum Lake Level (m AHD)	Maximum Outflow (m^3/s)	Maximum Lake Level (m AHD)	Flow Reduction %
36 hour 1 in 200 design*	8,214	1,544,119	38141	71.4	1,971	70.24	94%
36 hours 1 in 500 design	10,455	1,624,119	5983	72.2	3,446	71.17	42%
36 hours 1 in 1000 design	12,031	1,772,752	6010	72.78	4,504	71.83	25%

48 hours 1 in 5000 design	14,278	2,562,553	9066	74.7	8,217	74.17	9%
72 hours 1 in 5000 design	13,181	2,880,602	8190	74.15	7,609	73.79	7%
96 hours 1 in 5000 design	11,870	2,948,032	7534	73.74	6,916	73.35	8%
120 hours 1 in 5000 design	12,727	3,005,136	7227	73.55	6,635	73.17	8%
January 2011 historic	10,470	2,650,000	7,528	74.98	4,512	74.25	40%
1974 historic	5,953	1,410,000	3,275	73.305	2,493	72.71	24%
1999 historic	6,358	1,220,000	2,312	72.23	1,561	71.48	33%

* Design event characteristics obtained from WA (2005)

It can be seen from the comparison of Table 5 and Table 6 that the reduction of the storage level to 75% can provide a significant reduction on the outflows from the dam when combined with an amended release strategy, but again this impact reduces as the magnitude of the event increases. This is consistent with the previous observations that reductions of at least 25% of the storage volume are required to significantly alter the outflows from the dam.

It is also important to note that even with the reduction of the storage level to 75% and the amended flood operation rules, the storage level still exceeds EL74 for the January 2011 Flood Event. The changes would result in reduced flood levels downstream but would not prevent damaging flows through Brisbane.

7 References

DPI (1995) Department of Primary Industries Qld, Water Commercial, "Wivenhoe Dam Design Report – Volume 1 – Text", WS094, September 1995

WA (2005) Wivenhoe Alliance, "Design Discharges and Downstream Impacts of the Wivenhoe Dam Upgrade, Q1091, September 2005

WRM (2006) WRM Water and Environment, "Brisbane Valley Flood Damage Minimisation Study – Brisbane City Flood Damage Assessment, Brisbane City Council City Design, October 2006

8 Attachment A

Rainfall Forecasting for the Wivenhoe Dam Catchment

Background

1. On 6 July, Chris Russell, of Connell Wagner, met with Mike Bergin and Peter Baddiley seeking advice regarding the predictability of significant rain events over the Wivenhoe Dam catchment. Connell Wagner has been engaged by SEQWCo to provide advice on the feasibility of maintaining the water level in the Wivenhoe storage at one metre above Full Supply Level. As a part of the dam operations under that scenario, it would be required that the additional storage above FSL be released ahead of a major inflow into Wivenhoe Dam. This would require some 24 to 48 hour advance prediction of catchment average rainfalls in the order of 300mm in 24 hours; 375mm in 36 hours and/or 430mm in 48 hours.

2. Wivenhoe Dam catchment is located to the north-west of Brisbane and has an area of about 7,000 square kilometres. For meteorological forecasting, the catchment is broadly about 100 km in the north-south direction, and 70 kilometres wide (east-west); bounded in the west by the Dividing Range with its eastern boundary varying from about 40 to 80 kilometres inland from the coast. The distribution of rainfall over the catchment is significantly influenced by the topography in major events.

Discussion

3. As discussed at the meeting, the experience of Meteorologists and Hydrologists in the Brisbane office of the Bureau is that the short to medium term (0 to 48 hour) prediction of rainfall for the purpose of objective use in flood forecasting models is a difficult task. Quantitative Precipitation Forecasts (QPF) are available from the Australian and international Numerical Weather Prediction (NWP) models and have been used subjectively in the Brisbane office for many years. Whilst the NWP models have shown improvement in the accuracy of QPF over the past decade or so, there is still at times considerable error or uncertainty, in the prediction of the location, amount and timing of rainfall events at the catchment scale.

4. The improved skill of NWP models in recent years has particularly been in forecasting the development and movement of broad-scale synoptic features that would be likely to produce the threshold rainfall amounts in question. These large-scale features include decaying tropical cyclones, east coast low pressure systems and significant upper level troughs. However while these systems maybe well forecast on a time scale of 2 to 3 days the very heavy rainfall concentrations are dependent on finer scale (mesoscale) and convective features. Whilst there is often the ability to forecast the potential for a significant rain event to occur in the southeast Qld-northern NSW region, it is difficult (if not impossible) to predict the actual location of the heaviest rain, even with only a few hours notice.

5. Examples of high rainfall events that have occurred in the past 10 to 15 years in this region, some of which had little to no advance prediction of the "precise" location and/or magnitude of resulting rainfall, include Feb 1991, Dec 1991, Feb 1992, May 1996, Feb 1999, Mar 2001 and June 2005. Several of these events were not produced by large-scale features but by slow moving convergence zones which the current modelling capability cannot adequately predict. The two most recent events in 2001 and 2005 were relatively short-lived events and occurred at different times of the day – 2001 in the afternoon and 2005 overnight. While one could reasonably expect that most really significant rainfall events are most likely through the warmer months, winter extreme events are by no means rare.

6. Considerable effort is being applied to derive improved deterministic and probabilistic QPFs from NWP models. In the near future, the Bureau will be providing a publicly available rainfall forecasting service via a website. The rainfall predictions will be generated automatically by combining the outlooks from a suite of Australian and international. Forecast rainfall amounts for 24 hour periods will be given for 4 days ahead, together with the chance of exceeding various amounts from 1mm to 50mm. The latter is a "pseudo" measure of probability based on the consistency in the forecast rain amounts given by up to eight NWP models used in deriving the rainfall forecast. Whilst it is not considered that this will provide a sufficiently accurate method for objective decision making for pre-releases from Wivenhoe Dam, the probabilistic rain forecasts may provide a basis for a risk management approach. There may need to be further studies on risk quantification for prediction of high to extreme rainfall events to support this approach. Given that there are large levels of uncertainty in rainfall forecasts, the forecasting of hydrological response may require an ensemble of future rain scenarios to be considered for the Wivenhoe Dam application.

7. As for a potential service provided by the Bureau an alert type product would seem to be the best alternative where the potential for an extreme rainfall event in the following 2 to 3 days across southeast Queensland was given a rating on say a 3 level scale. If that rating was high then a second phase could be activated which could provide more detailed forecast of expected rainfall amounts and location. However I emphasise that this type of service can be expected to not provide the required 2 days advice of an event on some occasions and may fail to provide anything more than a few hours notice, such is the nature of the predictability of the mesoscale components of these events.

8. Currently the Bureau provides a QPF service for the dams in Southeast Queensland. This twice-daily service predicts the average rainfall across the catchments in the following 24-hour period. We have not undertaken any verification of the service. However it is likely that verification would show reasonable skill in identifying rainfall events but quite poor skill in predicting extreme events. This service is to be reviewed in the next few months and we may commence charging for the product as it is essentially not a basic service and should not be publicly funded. We have yet to commence discussions with the client so these comments should be kept confidential. This issue is raised because any future customized product provided in support of dam operations will certainly be on a fee for service basis. There is also the issue of whether the Bureau would have the capacity to provide such a service at all and that would have to be part of any future discussions.

Summary

9. In light of the demand for water in southeast Queensland and the highly variable nature of rainfall in the area the project has many obvious attractions. However the capability of the science to provide sufficiently reliable 24 to 48 hour advance predictions of high catchment average rainfalls is limited. The Bureau would be willing to participate in future discussions on the subject and maybe able to assist with some service that would assist.

Mike Bergin
Manager Weather Services,
Bureau of Meteorology, Queensland.

Peter Baddiley
Supervising Engineer Hydrology
Bureau of Meteorology, Queensland

24 July 2006

9 Attachment 2 - Extracts from the Wivenhoe Design Report

"JP-11"

seqwater
WATER FOR LIFE

7 February 2011

Mr John Bradley
Director General
Department of Environment and Resource Management
Level 13
400 George Street
BRISBANE QLD 4000

Dear John,

Impact of Reducing the Full Supply Level of Wivenhoe Dam on Flood Discharges

I refer to correspondence from The Honourable Stephen Robertson MP, Minister for Natural Resources, Mines and Energy, and Minister for Trade, dated 20 January 2011. I confirm that, as requested, Seqwater has undertaken further simulation modelling to assist DERM in its consideration of the appropriate Full Supply Level (*FSL*) for Wivenhoe Dam. The purpose of the modelling is to provide information to assist DERM in formulating a policy position by providing an indicative assessment of a range of FSLs and pre-release strategies to pre-emptively reduce the FSL of Wivenhoe Dam.

I enclose a memorandum *Impact of Reducing the Full Supply Level of Wivenhoe Dam on Flood Discharges*, which provides a summary of Seqwater's preliminary assessment into the impact of reducing the initial storage level of Wivenhoe Dam on the downstream discharges for major flood events. A number of scenarios are presented in the memorandum for consideration by DERM in determining, from a policy perspective, whether the FSLs for Wivenhoe Dam should be changed.

The scenarios presented in the memorandum provide an approximate analysis to help inform discussion and for further consideration by DERM. The review is intended only to provide an order of magnitude assessment of impacts and the results should not be utilised beyond that purpose. More accurate estimates would require a detailed investigation and analysis of the entire river system utilising multiple flood events and a combination of hydrologic, hydraulic, and routing models.

The analysis is based upon computer modelling of simulated gate opening sequences specified in the Flood Mitigation Manual during a "loss of communications" scenario. For the reasons noted in section 2 of the enclosed memorandum, while this scenario provides a consistent means of comparing the efficacy of different mitigation options, the actual degree of flood reduction achievable is dependent on the characteristics of the specific event. The model utilised adopts flood inflows that have been derived from an analysis of past historic events, in combination with design hydrographs developed previously for design and planning purposes by the Wivenhoe Alliance (2005).

The applicable assumptions for the modelled options, presented in section 2 of the memorandum, apply equally to the scenario set out in the correspondence from Seqwater's Chairman, Phil Hennessy, to Minister Robertson, dated 4 February 2011.

Yours sincerely,

Peter Borrows
Chief Executive Officer

Encl.

seqwater

WATER FOR LIFE

Impact of Reducing the Full Supply Level of Wivenhoe Dam on Flood Discharges

1 Introduction

This memo provides a summary of a preliminary assessment into the impact of reducing the initial storage level of Wivenhoe Dam on the downstream discharges for major flood events. Information is provided on the impacts of reducing the Wivenhoe Dam initial storage level to 95%, 90%, 85%, 75% and 50% of the normal full supply level (EL67.0M AHD).

2 Assumptions and Caveats

The analysis was undertaken using a computer model to simulate the gate opening sequence as provided in the Flood Manual during a "loss of communications" situation. During a loss of communications between the dam operators and the Flood Control Centre, operators would use predefined gate openings based solely on the Lake Level information available to them at the dams. It should be noted that in practice gate operations would normally seek to take advantage of additional information related to rainfall forecasts and tributary flows to ensure that flood peaks are reduced as far as possible without causing coincident flooding with downstream tributaries. Thus, while using the "loss of communications" flood operation rules provides a consistent means of comparing the efficacy of different mitigation options, the actual degree of flood reduction achievable is dependent on the characteristics of the specific event.

Flood inflows to the model were derived from an analysis of past historic events (1974, 1999, and 2011), in combination with "design hydrographs" developed previously for design and planning purposes (Wivenhoe Alliance, 2005[1]). These "design hydrographs" are obtained from models of both the rainfall and flood generation process, whereby floods of a given magnitude are assigned a specified probability of exceedance (eg a "1 in 200" event).

It should be stressed that the information presented here is based on approximate analyses to help inform discussion. More accurate estimates would require a detailed investigation and analysis of the whole river system utilising multiple flood events and a combination of hydrologic, hydraulic, and routing models. This review should thus be seen as providing an order of magnitude assessment of impacts and the results should not be utilised beyond that purpose.

[1] Wivenhoe Alliance, "Design Discharges and Downstream Impacts of the Wivenhoe Dam Upgrade, Q1091, September 2005

3 Options Considered

Five options are explored in this paper, as summarised in the following table:

There are five options considered going forward.

Option	Description	Comments
0 'Do nothing'	Continue with the current approved flood operation rules – that is, maintain the status quo and continue to utilise the dam as originally designed.	This option has utilised the existing strategies that have been implemented and refined over several flood events and the manual was developed by a comprehensive study.
1 'Early release'	Change the flood operating rules to ignore the early strategies designed to minimise disruption to the rural communities	Increase the release from the dam up to 1600 m³/s as soon as practicable after gate operations commence; it is assumed that no attempt would be made to maintain bridge access downstream of the dam other than Mt Crosby Weir Bridge and the Brisbane Valley Highway Bridge.
2 'Pre-release'	Implementing a significant release of water once the notification of a major rainfall event has been received.	The reliability of forecasts by the Bureau of Meteorology are such that they do not allow the reservoir to be drawn down in a timely manner without potentially causing appreciable 'artificial' flooding downstream.
3 '75% FSL'	Lower the storage level in Wivenhoe Dam to 75% of the current full supply level, and operate the dam under the current operating rules.	To safely lower the storage it is proposed that this option would be implemented by 'Sunny Day' releases at a rate low enough to minimise disruption to the rural areas. This would be difficult to implement during a wet year where the risk of major flooding is greater. Once the storage level reached EL67 gate operations would commence as per the current flood manual.
4 '85% FSL amended'	Lower the storage level in Wivenhoe Dam to 85% of the current full supply level and amend the current flood manual to commence releases once the storage level exceeds EL65.25	The amended flood operating rules would retain the key level in the manual of EL74m, where the gates are opened until the flood level stops rising. This would require a change by the Queensland Government to the regulatory requirements and levels of service that the storage is operated under.
5 '75% FSL amended'	Lower the storage level in Wivenhoe Dam to 75% of the current full supply level and amend the current flood manual to commence releases once the storage level exceeds EL64.00	Same comment as for Option 4.

4 Results

The results of this analysis is summarised in Table 1 and Table 2.

Flood Event			Option 0 - Existing Rules		Option 1			Option 4			Option 5		
Event description	Maximum Inflow (m³/s)	Flood Volume (ML)	Maximum Outflow (m³/s)	Maximum Lake Level (m AHD)	Maximum Outflow (m³/s)	Maximum Lake Level (m AHD)	Flow Reduction %	Maximum Outflow (m³/s)	Maximum Lake Level (m AHD)	Flow Reduction %	Maximum Outflow (m³/s)	Maximum Lake Level (m AHD)	Flow Reduction %
36 hour 1 in 200 design*	8,214	1,544,119	3,861	71.43	3,613	71.27	6%	2,639	70.66	32%	1,971	70.24	49%
36 hours 1 in 500 design	10,455	1,624,119	5,125	72.22	4,915	72.09	4%	4,028	71.53	21%	3,446	71.17	33%
36 hours 1 in 1000 design	12,031	1,772,752	6,049	72.8	5,854	72.68	3%	5,031	72.16	17%	4,504	71.83	26%
48 hours 1 in 5000 design	14,278	2,562,553	9,083	74.71	8,994	74.66	1%	8,535	74.37	6%	8,217	74.17	10%
72 hours 1 in 5000 design	13,181	2,880,602	8,204	74.16	8,101	74.1	1%	7,821	73.92	5%	7,609	73.79	7%
96 hours 1 in 5000 design	11,870	2,948,032	7,550	73.75	7,426	73.67	2%	7,135	73.49	5%	6,916	73.35	8%
120 hours 1 in 5000 design	12,727	3,005,136	7,265	73.57	6,986	73.39	4%	6,751	73.25	7%	6,635	73.17	9%
January 2011 historic	10,470	2,650,000	7,528	74.98	7,452	74.95	1%	5,746	74.62	24%	4,512	74.25	40%
1974 historic	5,953	1,410,000	3,275	73.31	3,159	73.26	4%	2,737	72.91	16%	2,493	72.71	24%
1999 historic	6,358	1,220,000	2,312	72.23	2,251	72.504	3%	1,814	71.89	22%	1,561	71.48	32%

Table 1 – Option Results

* Design events taken from the Wivenhoe Alliance (2005)

Flood Event			Option 0 - Existing Rules (Storage Level 100%)		Storage Level 95%		Storage Level 90%		Storage Level 85%		Storage Level 75% (Option 3)		Storage Level 50%	
Event description	Maximum Inflow	Flood Volume	Maximum Outflow	Maximum Lake Level	Maximum Outflow	Flow Reduction	Maximum Outflow	Flow Reduction	Maximum Outflow	Flow Reduction	Maximum Outflow	Flow Reduction	Maximum Outflow	Flow Reduction
	(m^3/s)	(ML)	(m^3/s)	(m AHD)	(m^3/s)	%	(m^3/s)	%	(m^3/s)	%	(m^3/s)	%	(m^3/s)	%
36 hour 1 in 200 design*	8,214	1,544,119	3,861	71.43	3,579	7%	3,237	16%	2,965	23%	2,356	39%	1,134	71%
36 hours 1 in 500 design	10,455	1,624,119	5,125	72.22	4,863	5%	4,531	12%	4,271	17%	3,693	28%	2,213	57%
36 hours 1 in 1000 design	12,031	1,772,752	6,049	72.8	5,795	4%	5,478	9%	5,235	13%	4,705	22%	3,329	45%
48 hours 1 in 5000 design	14,278	2,562,553	9,083	74.71	8,949	1%	8,779	3%	8,645	5%	8,339	8%	7,397	19%
72 hours 1 in 5000 design	13,181	2,880,602	8,204	74.16	8,111	1%	7,995	3%	7,902	4%	7,689	6%	7,071	14%
96 hours 1 in 5000 design	11,870	2,948,032	7,550	73.75	7,447	1%	7,325	3%	7,233	4%	7,017	7%	6,404	15%
120 hours 1 in 5000 design	12,727	3,005,136	7,265	73.57	7,098	2%	6,911	5%	6,829	6%	6,702	8%	6,360	12%
January 2011 historic	10,470	2,650,000	7,528	74.98	7,453	1%	6,756	10%	5,876	22%	5,748	24%	4,209	44%
1974 historic	5,953	1,410,000	3,275	73.31	3,153	4%	2,974	9%	2,810	14%	2,618	20%	2,067	37%
1999 historic	6,358	1,220,000	2,312	72.23	2,132	8%	2,003	13%	1,920	17%	1,687	27%	1,007	56%

Table 2 – Routing Results for Storage Levels using the current Flood Manual Rules

5 Conclusions

Reductions in outflow flood can be achieved by the adoption of different storage levels and release strategies. However, due to the large volumes of water associated with major flood events, it is necessary to consider large changes to the full supply level to achieve appreciable reductions in flood magnitude. The impact of different initial storage levels reduces as the magnitude of the event increases.

"JP-12"

JB, ~~AB~~, Greg Claydon
Debbie Best,
PB, M.F, JP, ~~FXM~~.

8.2.11

JB meeting

JB
1 - Status of work - modelling
2 - Contingency protocol
3 - Guest assessment - advice

JB - How is it going
1/ PB - Sent across this morning to JB/DB/GC/P.A: 9:00am with sign off from Lawyers/insurers/Chairman
JB - generally keen to get this process - first draft in licences as opposed to an express view on potency
- asked questions on recommendation?
- will come back to this later JB
PB - As a result of last finding - again highlight what sort of
2/ Contingency protocol an client is trying to be things

DB - Have we considered Greg's Claydon's email
- triggered
- approved
- made effective

A Letter on 4/2/11 - "assist DBRM" - assist DBRM"
relatively surprised by that comment as opposed to considering doesn't actually ask for that. Asks for as part of manual - our view about FSL regulator might help consider - ?!?
JB - implied in interaction also week asking for explicit advice for support
PB - Completion of review of impact in manual - will not be a review of FSL but aimed to early. With sensitive dialogue!!
JB - DBRM point of view I can't comprehend!! how owner & operator can't come to a corporate position on FSL that is required. Quoted various clauses - hasn't stepped away from Manual - Ministers letter at all!
This went sour - : NO OWNERSHIP TAKEN

taking

NOT CONTROL — Seqwater not taking ownership operating manual

NO OWNERSHIP — there's regulatory instrument which stipulates FSL!

What are we ... — even if we wanted to take it on OBRM can't take on the decisions as no instrument

... to protect ... ? PB. — Is the manual a tool or a decider of the FSL — now specifying? FSL.

against

JB — now Regulatory instrument that governs

Pump operators/ stability all — Lower FSL in these conditions would only require a document to do this year

This may / PB — Clause not used for that purpose

/ JB — If this isn't the instrument what is it? not ROP!

... boundaries

PB — RWSS agreement and water resource planning

JB — Current water security position — Driver is clearly to take flood mitigation into the 6 week extend

JB — Beyond the normal bounds of gravity
— Expectation from Minister that we consider & take into account the gravity of the current situation ...

PB — Hear the argument not where Board is

JB — Make advice to be more general
— Not to come to a position & ... to be a fundamental vacation!! of the area we should be expert in!
— Can't understand how this gets done unless under the manual! Chair?
— time critical decisions Minister? ...

PB — Showers ⇒ won't go there

JB — Considered comment?
— know there is a plan to publish ...
— Minister / JB have a fundamental

PB - Get back to you

DB - Another phone call later in the day.

Allan at 5:30 p.m.

Telephone Discussion with John Bradley, Debbie Best, Greg Claydon, 8 February 2011 9.30am

Seqwater attendees: Peter Borrows, Jim Pruss, Mike Foster, Fiona Murdoch

John Bradley requested that the meeting cover 3 items:

1. Status of Seqwater's modelling work
2. Contingency Protocol
3. Assessment and advice

PB agreed with the agenda.

1. Status of Seqwater's modelling work

JB enquired as to the status of the modelling.
PB advised that he had sent the modelling output across this morning in an email to JB, cc to DB, GC and PA at approximately 9.00am. PB advised that this document had been through the lawyers, the insurers and the Chairman.
JB enquired whether the document expressed a view on Seqwater's preferences or contained a recommendation or was simply data.
PB advised that it was the results of the modelling as was discussed at the meeting last Friday and did not make a recommendation.
PB highlighted that a key issue is what sort of event was trying to be improved and mitigated against, e.g. 1:100, 1:500, 1:5000 year event.
PB confirmed that JP would be the contact for any queries relating to the modelling content.

2. Contingency Protocol

JB asked whether Seqwater had considered GC's email of last night (7.11pm).

PB advised that he had had a preliminary consideration but had not had the opportunity to fully discuss with relevant staff. PB confirmed that he was wanting further details of the issues raised in GC's email.

JB referred to the letter provided by the Chairman of Seqwater to the Minister on 4 February. He stated that the letter had been written with repeated references to "Seqwater to assist DERM".

JB stated that collectively, including the Minister, they were surprised by the expression of the owner and operator of the dam Seqwater's response. JB stated that the Minister's earlier letter did not ask for Seqwater's assistance it asked for Seqwater to expedite its review under the Flood Operations Manual including a consideration of the FSL. JB stated that it was implicit in the interactions over the last week, they were asking for explicit advice from Seqwater on the FSL.

PB stated that this had already been discussed a number of times, including last Friday, and therefore consideration of FSL would not be part of Seqwater's regulatory report. PB advised that Seqwater was working to complete the regulatory report under the 6 week period but it would be very close to the due date.

JB stated that they had a different expectation of the view that Seqwater would bring to this matter and a different expectation of the advice from Seqwater under the manual.

PB stated that he did not see the review under the manual driving a change of FSL. PB stated that there was a fundamental difference between FSL from a water security point of view to the level for the flood mitigation manual. PB pointed to the standards for flood mitigation and said that was not a Seqwater decision.

JB stated that from DERM's point of view he could not comprehend how an owner and operator can't come to a corporate position on FSL as required by the statutory report under the manual. JB stated that the duty operators have significant discretion in how they operate under the manual and that there is flexibility throughout the manual.

PB stated whilst there was some flexibility it was in the context of very prescriptive parameters approved by the regulator and gazetted.

JB further stated that Seqwater appeared to be not taking control and that there was no ownership by Seqwater. JB stated that Seqwater was passing the issue back through government without analysis and advice.

JB asked if the manual was not the regulatory instrument to change or specify the FSL where has FSL been set in regulations? JB stated that even if DERM wanted to take it on DERM could not do that was there was no instrument to do so. JB said it appears that Seqwater is not capable of making that decision.

PB stated the question whether the manual is a taker of FSL or a decider of FSL? PB stated that Seqwater's view is that the manual is a taker of FSL.

JB stated that the manual was now the operating framework that specifies FSL and was therefore the regulatory instrument. JB stated that to therefore lower FSL in this current environment would require a tactical change only for this year.

PB replied that Seqwater considered that the SEQ Water Supply Strategy, ROP and the water planning process are the specifiers of the FSL.

JB stated that if there was to be a fundamental long term change to the FSL requiring a change of the yield he indicated that the strategy and ROP would be relevant instruments. JB however stated that this was a temporary change and therefore a variation to the manual was appropriate and could be done in that regulatory context. JB stated that Seqwater could use section 3 to say what FSL is for the next 12 months.

JB stated that if the manual was not the instrument to change FSL – what is the other regulatory instrument – it is not the ROP.

PB reiterated the water supply security position and that it takes FSL as part of it. PB further stated that it was a balance of water supply and flood mitigation under the water resource planning framework.

JB agreed to the fundamental premise however stated that we were in a situation that was beyond the normal bounds of gravity of decisions envisaged by the manual.

JB stated that it was the expectation of the Minister that Seqwater consider this and take into account the gravity of the situation. JB stated that the Minister expected the Board to provide corporate decisions on FSL.

PB stated that he heard his position but that there were too many variables given that different events produced significantly different outcomes. PB further highlighted the limited time to undertake appropriate analysis.

JB stated that Seqwater is the organisation that takes into account downstream impacts through the manual. JB further stated that it should be Seqwater's view in relation to pre-emptive releases or accelerated releases when needed.

JB stated to not come to a position on the benefits and desirability of changing FSL/releases is a fundamental vacation of the area that we should be expert in. JB stated that he could not understand how change gets done without using the manual.

JB offered to talk with the Chairman of Seqwater and also for the Minister to talk with the Chairman.

JB stated that it was a time critical decision. JB stated that they wanted a clear timeframe for how long to complete the review and the FSL advice.

JB stated that the issue at the moment was that we needed to work through this as we are at 100% and have a community on tenderhooks and that we need a plan.

JB stated the Minister and himself had a fundamental concern about the lack of progress. JB stated that we are in real time operational mode that Seqwater needs to be able to function in.

PB stated that we have heard all this and discussed this a number of times and as stated it is the Board's position taking advice from the lawyers and insurers.

JB stated that he was sure that there was nothing in Seqwater's insurance policy that would prevent Seqwater from fulfilling its regulatory obligation.

PB advised that he would have to talk with the Chairman and insurers based on this further discussion.

JB asked for a phone call from PB later in the day advising on where Seqwater was at.

"JP-13"

SEQ Water Grid manager

Secure and efficient water through partnership and innovation

TRIM ref: D/11/502

9 February 2010

Peter Borrows
Chief Executive Officer
Seqwater
PO Box 16146
City East QLD 4002

Dear Mr Borrows Peter

I refer to Seqwater's Chair's letter to Minister Robertson dated 4 February 2011, regarding Seqwater's consideration of the appropriate Full Supply Levels (FSL) for Wivenhoe and Somerset dams. We acknowledge having recently received a copy of this letter from you.

I write regarding the water security impacts of lowering the FSL of Wivenhoe Dam, in light of the SEQ Water Grid Manager's obligation to manage water supplied from its water entitlements in accordance with Sections 6 and 7 (Desired Levels of Service Objectives and Risk Criteria) in the *South East Queensland System Operating Plan*. We understand that this is being considered as an interim measure for the current wet season.

I confirm previous verbal advice that, from a water security perspective, the SEQ Water Grid Manager has no objection to Wivenhoe Dam being drawn down to 75 per cent of its FSL. The water security implications of a temporary draw down are unlikely to impact our ability to comply with the *South East Queensland System Operating Plan* or our Grid Contract obligations.

If a permanent reduction of Wivenhoe Dam's FSL is later considered, this may have an impact on the *South East Queensland System Operating Plan's* desired levels of service objectives and we would suggest that you also engage with the Queensland Water Commission on this matter.

I trust that this advice is sufficient. If you have any questions, please do not hesitate to contact me by telephone on [redacted] or via email at [redacted]

Yours sincerely

[redacted]

Barry Dennien
Chief Executive Officer

CC: Karen Waldman, Chief Executive Officer, Queensland Water Commission.

PO Box 16205, City East QLD 4002 Tel: [redacted] Fax: +61 7 3405 0373 www.seqwgm.qld.gov.au
ABN: 14 783 317 630

"JP-14"

seqwater
WATER FOR LIFE

10 February 2011

Mr John Bradley
Director-General
Department of Environment and Resource Management
Level 13, 400 George Street
BRISBANE QLD 4000

Dear John,

Further to our Chairman's letter to the Honourable Stephen Robertson MP, Minister for Natural Resources, Mines and Energy, and Minister for Trade, of 4 February 2011, I advise that the SEQ Water Grid Manager informed Seqwater by the attached letter, received yesterday, 9 February 2011, that it has no objection, from a water security perspective, to Wivenhoe Dam being drawn down to 75% of its Full Supply Level (*FSL*) and that such a draw down, if temporary, would be unlikely to impact its obligations.

You will recall that, pursuant to Minister Robertson's earlier request, Seqwater undertook modelling of various potential flood events (which included approximately 90 permutations in respect of 3 previous flood events and 6 design flood events) and confirmed to you that a reduction in Wivenhoe Dam's storage level to 75% of its FSL will provide appreciable flood mitigation benefits. Reducing storage to this level will effectively increase the capability of the dam to further mitigate flood events (depending on rainfall conditions downstream of the dam).

By way of example, the simulation modelling undertaken by Seqwater, which was peer reviewed by independent experts and submitted to you with Seqwater's letter dated 7 February 2011, demonstrated, subject to the qualifications referred to in that letter, that the reduction in storage level of the Wivenhoe Dam to 75% of its FSL achieved (approximately):

(a) a flow reduction from 3900 cumecs to 2400 cumecs (being a 39% reduction) in the case of a 36 hour 1 in 200 design flood event; and

(b) a flow reduction from 5100 cumecs to 3700 cumecs (being a 28% reduction) in the case of a 36 hour 1 in 500 design flood event.

Seqwater notes the extreme January 2011 flood event resulted in 2,650,000 ML of flood water passing through Somerset and Wivenhoe Dams, which was 1,240,000 ML more than the 1974 floods.

In light of the SEQ Water Grid Manager's abovementioned advice to Seqwater, the extreme nature of the January 2011 event and the abovementioned modelling results, Seqwater recommends that Wivenhoe Dam's storage level be temporarily reduced to 75% of its FSL in order to temporarily increase its flood mitigation capacity. Should the State agree with this recommendation, Seqwater will then confer with your Departmental officers to explore the various options by which this outcome can most promptly be achieved.

I look forward to receiving your response.

Yours sincerely,

[redacted]

Peter Borrows
Chief Executive Officer

Attach.